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3 EFFECT OF COMBINED ENDRIN-ARASAN 75 AND THIOUREA TREATMENTS ON THE GERMINATION OF BITTERBRUSH SEED

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Reed Sanderson
Pacific Southwest Forest and Range Experiment Station,
Susanville, California

and

Don McIntosh
U. S. Fish and Wildlife Service,
Riverside, California

Rodent depredations have caused high losses to bitterbrush plantings in Idaho (Holmgren and Basile, 1959) and Washington (Brown and Martinsen, 1959). In California only a few losses can be entirely attributed to rodents, but those few are sufficient warning that preventive action may be necessary. An effective rodent repellent recommended by the U. S. Fish and Wildlife Service is endrin and Arasan 75. However, before using this repellent, we need to know if it is compatible with the thiourea treatment that is necessary for spring planting.

Accordingly, seeds from nine California sources were treated with endrin-Arasan 75 and thiourea. Only two of the nine showed reduced germination, and therefore treatment with the rodent repellent in combination with thiourea can be recommended. But because of the erratic results with seed from the two sources, a sample of seed should be treated and tested for germination before the entire lot is used.

Seed Treatment

Seeds of antelope bitterbrush (*Purshia tridentata*) from six locations and of desert bitterbrush (*P. glandulosa*) from three locations were used in this study.

Purshia tridentata:

Date of Collection	Location
1954	Janesville, Lassen Co., Calif.
1954	Deschutes, Oregon
1955	Janesville, Lassen Co., Calif.
1957	Timber Mtn., Modoc Co., Calif.
1957	Siskiyou and Klamath Co., Calif.
1959	Buttermilk Range, Inyo Co., Calif.

Purshia glandulosa:

Date of Collection	Location
1959	Valyermo, Los Angeles Co., Calif.
1959	Georges Creek, Inyo Co., Calif.
1959	McMurray Meadows, Inyo Co., Calif.

Seeds from all nine sources were given three different treatments: (1) Thiourea bath followed by application of endrin-Arasan 75; (2) endrin-Arasan 75 application followed by thiourea bath; (3) a thiourea bath alone--the control treatment. Thiourea was applied by soaking the seeds in a three percent solution for 5 minutes. The only exception was seed from the Timber Mountain source which was soaked for 15 minutes because previous tests had shown the need for longer soaking of this seed.

The seed was treated with endrin-Arasan 75 by the U. S. Fish and Wildlife Service, which applied 1 gram of endrin and 2 grams of Arasan 75 per 100 grams of seed. The endrin and Arasan 75 powders were blended and affixed to the seed coat with a water-solvent asphalt emulsion. First, the emulsion was applied in sufficient quantity to thoroughly wet the seed coat. Then the endrin-Arasan 75 blend was added and the seeds agitated until an even coating was achieved. Finally aluminum powder was added to prevent caking of the seed as a result of the adhesive coating and to increase avoidance by birds.

It was noted during the coating of the seed with asphalt emulsion that some seed groups 1/ required heavier amounts of asphalt emulsion to provide the proper adhesive coating.

1/ A seed group describes a single treatment to seed from an individual source; with 3 treatments and 9 seed sources there are 27 seed groups.

Test No. 1 - Germination

The germination test was replicated in 3 lots of 50 seeds each for 3 treatments and 9 seed sources. Germination blotters were placed in petri dishes and soaked in tap water for at least 5 minutes, then drained. Fifty seeds were placed on each blotter. Germinated seeds were removed and tallied every 24 hours. The germination test was originally designed to cover a period of 15 days, but an additional 15 days were included to see if some slow germinating seed groups would improve.

The daily rate of germination was charted, and percent germination was computed for each seed group at the end of 15 and 30 days.

Test No. 2 - Water Absorption

To check whether the heavier applications of asphalt emulsion reduced the rate of water absorption, a sample of 200 seeds from each seed group was weighed to the nearest thousandths of a gram and placed on saturated germination blotters. The samples were re-weighed at the end of the first and second hour and then at 2-hour intervals. Each time the seed was weighed, the germination blotters were thoroughly soaked and drained to insure an adequate supply of moisture for the seeds. Care had to be taken so that a surplus of water would not accumulate in the petri dish, cling to the seeds, and give an incorrect weight. Weighing was handled as rapidly as possible to minimize evaporation from the seeds. The duration of this test was 8 hours; by that time some of the seeds had already begun to exude red sap which prevented further accurate weighing of the samples.

Results

Treatment with endrin-Arasan 75 and thiourea--regardless of the sequence--did not significantly reduce germination of bitterbrush seed (tables 1 and 2). The variation due to seed source, although significant, is not of particular interest since a wide variation in germination can be expected of seeds collected from different sites and under different climatic conditions (Wagle, 1956). However, the highly significant variation due to interaction between treatment and seed source is of interest.

To analyze this variation, it was necessary to consider each seed group individually. This analysis indicated that some treatments had a significant effect on some seed groups (table 3).

Multiple comparisons using Scheffer's (1959) method were then employed to identify the specific treatments that were causing the significant variation. The results showed that after 15 days the Janesville 1955 seed with repellent plus thiourea, and the Timber Mountain seed with thiourea plus repellent, had significantly lower germination than their respective alternate treatments. At the end of 30 days, the percent germination of Janesville 1955, with thiourea plus repellent was still significantly lower than germination of seed from the same source with the alternate repellent treatment, but not significantly less than the control. However, there were no significant differences in total germination within the Timber Mountain seed source at the end of 30 days.

In one case, the Janesville 1955 seed with repellent plus thiourea, germination was higher than that of the respective control.

The germination rates of these two erratic groups were slower than those of any other seed group (table 1). In general, at the end of four days, approximately 70 percent of the seeds from the other seven seed sources had germinated. In contrast, the seeds from the Janesville 1955 seed group had only 9 percent germination and those from the Timber Mountain seed group had 22 percent germination at the end of four days.

This erratic germination was hypothesized to result from the reduced rate of water absorption because of the heavier applications of asphalt emulsion. Seed groups treated with endrin-Arasan 75 did absorb water at a slower rate than those treated with thiourea only (table 4). However, there is no evidence that the asphalt emulsion reduced water absorption to the point that germination was inhibited. For example, Janesville 1955 seed treated with thiourea and then endrin-Arasan 75 had a 41 percent weight increase and 55 percent germination, whereas the alternate repellent treatment had a 46 percent weight increase but only 13 percent germination. The control treatment had a higher percentage weight increase (83 percent) but a lower percent germination (41 percent) than the thiourea plus endrin-Arasan 75 treatment.

The reasons for the erratic germination of these two seed groups and two different treatments is not clear. However, there is sufficient evidence to warrant a note of caution when using endrin-Arasan 75 treatments in combination with thiourea. To be on the safe side, germination tests should be made on treated samples before a large quantity of seed is prepared for planting.

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Table 1.--Percent germination of bitterbrush seed treated with endrin-Arasan 75 and thiourea at the end of 4, 15, and 30 days

Seed source	Treatments								
	Thiourea & Endrin-Arasan 75			Endrin-Arasan 75 & Thiourea			Thiourea Only-Control		
	Day 4	Day 15	Day 30	Day 4	Day 15	Day 30	Day 4	Day 15	Day 30
Janesville, 1954	84	87	87	85	87	87	83	85	88
Deschutes, 1954	82	83	90	74	82	85	79	83	86
Janesville, 1955	46	55	60	9	13	24	34	41	47
Timber Mtn., 1957	22	41	67	81	84	84	85	86	87
Siskiyou, 1957	72	79	79	74	81	84	59	71	73
Buttermilk, 1959	99	99	99	94	94	94	96	97	99
Valyermo, 1959	89	94	95	91	95	97	90	93	96
Georges Cr., 1959	79	85	87	83	87	88	82	87	89
McMurray, 1959	68	69	69	67	68	69	64	65	67

Table 2.--Analysis of variance for total percent germination of bitterbrush seed at the end of 15 days

Source of variance	d. f.	S. S.	M. S.	F.
Total	80	16,658.88		
Seed source	8	12,855.11	1,606.89	92.88**
Treatment	2	63.07	31.52	1.82
Interaction	16	2,805.35	175.33	10.13**
Error	54	934.35	17.30	

** Significant at the 99% level.

Table 3.--Analysis of variance to test the effect of treatment interaction

Source of variance	d. f.	S. S.	M. S.	F.
Total	80	16,657.88		
Seed groups	26	15,723.53	604.75	34.96**
Error	54	934.35	17.30	

** Significant at the 99% level.

Table 4.--Comparison of percent weight increase due to water absorption at the end of 8 hours with percent germination at the end of 15 days

Seed source	Treatments					
	Thiourea & Endrin-Arasan 75		Endrin-Arasan 75 & Thiourea		Thiourea only-control	
	Pct.Wt.	Pct.Germ.	Pct.Wt.	Pct.Germ.	Pct.Wt.	Pct. Germ.
Janesville, 1954	34	87	30	87	66	85
Deschutes, 1954	32	83	36	82	73	83
Janesville, 1955	41	55	46	13	83	41
Timber Mtn., 1957	48	41	40	84	72	86
Siskiyou, 1957	40	79	67	81	84	71
Buttermilk, 1959	34	99	23	94	68	97
Valyermo, 1959	35	94	31	95	56	93
Georges Cr., 1959	37	85	45	87	61	87
McMurray, 1959	30	69	36	68	52	65
Average	37	77	39	76	68	79